

# CBCS SCHEME

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17AE/AS44

## Fourth Semester B.E. Degree Examination, Aug./Sept. 2020 Mechanisms and Machines Theory

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. With a neat figure, explain crank and slotted lever mechanism. (10 Marks)  
 b. Determine mobility of mechanism given below : Fig Q1(b) – (i), and (ii)

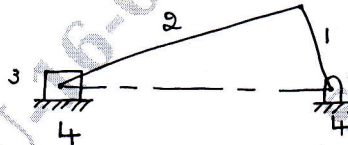


Fig Q1(b)-(i)

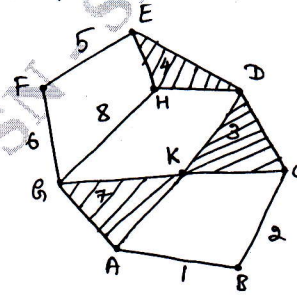


Fig Q1(b)-(ii)

(10 Marks)

OR

- 2 a. Obtain condition for correct steering for a four wheeled vehicle. (10 Marks)  
 b. Explain peaucillier's and Geneva wheel mechanism. (10 Marks)

### Module-2

- 3 a. Determine various forces on the link and couple  $T_2$  shown in Fig Q3(a) below. Where  $AB = 300\text{mm}$ ,  $BC = 600\text{mm}$ ,  $BD = 200\text{mm}$ .

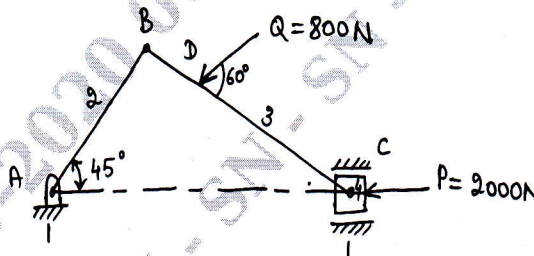


Fig Q3(a)

(16 Marks)

- b. Describe angular velocity and relative velocity. (04 Marks)

OR

- 4 A four bar mechanism ABCD is made up of four links, pin jointed at the ends. AD is a fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm long respectively. At certain instant, the link AB makes an angle of  $60^\circ$  with the link AD. If the link AB rotates at a uniform speed of 100rpm clockwise determine :

- i) Angular velocity of the links BC and CD  
 ii) Angular acceleration of the links CD and CB. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg.  $42+8=50$ , will be treated as malpractice.

**Module-3**

- 5 a. State and prove law of gearing. (10 Marks)  
 b. A Pair of spur gear has 16 teeth and 18 teeth, a module 12.5mm, an addendum 12.5mm and a pressure angle  $14.5^\circ$ . Prove that the gears have interference. Determine the minimum number of teeth and the velocity ratio to avoid interference. (10 Marks)

**OR**

- 6 a. Explain with neat sketches :  
 i) Compound gear train  
 ii) Epicyclic train. (08 Marks)  
 b. An epicyclic gear train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B, which drives wheel D through an Idler wheel C. 'D' being concentric with 'A' wheels B and C are carried on an arm which rotates clockwise at 100rpm about the axis of A and D. If the wheels B and D have 25 and 40 teeth respectively. Find the number of teeth on 'C' and the speed and sense of rotation of 'C'. (12 Marks)

**Module-4**

- 7 A shaft carries three rotating masses A, B and C of 10, 12 and 15kg respectively. Their radii of rotation are 6cm, 5cm and 8cm from the axis of the shaft. The plane of rotation of masses B and C are 50cm and 80cm from the plane or mass 'A' and on the same side of it. The angular position of masses 'B' and 'C' with respect to mass 'A' are  $75^\circ$  and  $140^\circ$  respectively both measured counter clockwise. If the radius of rotation of mass 'L' and 'M' are to be 10cm. Determine the balancing masses in the planes 'L' and 'M' and their angular position with respect to mass 'A'. The plane 'L' is 20cm to the left of plane 'A' and plane M is 100cm to the right of plane 'A'. (20 Marks)

**OR**

- 8 a. The pistons of a 4 cylinder vertical inline engine reach their uppermost position at  $90^\circ$  interval in order of their axial position. Pitch of cylinder = 0.35m. Crank radius = 0.12m, length of CR = 0.42m. The engine runs at 600rpm. If the reciprocating parts of each engine has a mass of 2.5kg, find the unbalanced primary and secondary forces couples. Take central plane of engines as reference plane. (14 Marks)  
 b. Why balancing of rotating masses necessary? (06 Marks)

**Module-5**

- 9 a. Derive an expression for height of porter governor. (08 Marks)  
 b. In a porter governor the upper and lower arms are each 200mm long and are hinged on the mass axis. Each ball weight 25N and the weight of the sleeve is 250N. The force of friction on the sleeve is 25N. The inclination of the arm to the vertical is  $30^\circ$  and  $45^\circ$  in the lowest and height position. Calculate :  
 i) Travel of the sleeve  
 ii) Speed at the bottom, middle and top, taking friction into account during upward travel  
 iii) Speed at the bottom, middle and top, during downward travel, considering friction  
 iv) Speed at the bottom, middle and top of the travel neglecting friction. (12 Marks)

**OR**

- 10 a. Describe the gyroscopic effect on airplane. (10 Marks)  
 b. An aeroplane makes a complete half circle of 40m radius towards left when flying at 175Km/hr. The mass of rotary engine and propeller is 400Kg with radius of gyration 300mm. The engine runs at 2500rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft. What will be the effect if the aeroplane turns towards right instead of left? (10 Marks)

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